

***Euphysothrips*: an Old World genus of Thripidae (Thysanoptera) associated with rust fungi (Pucciniales)**

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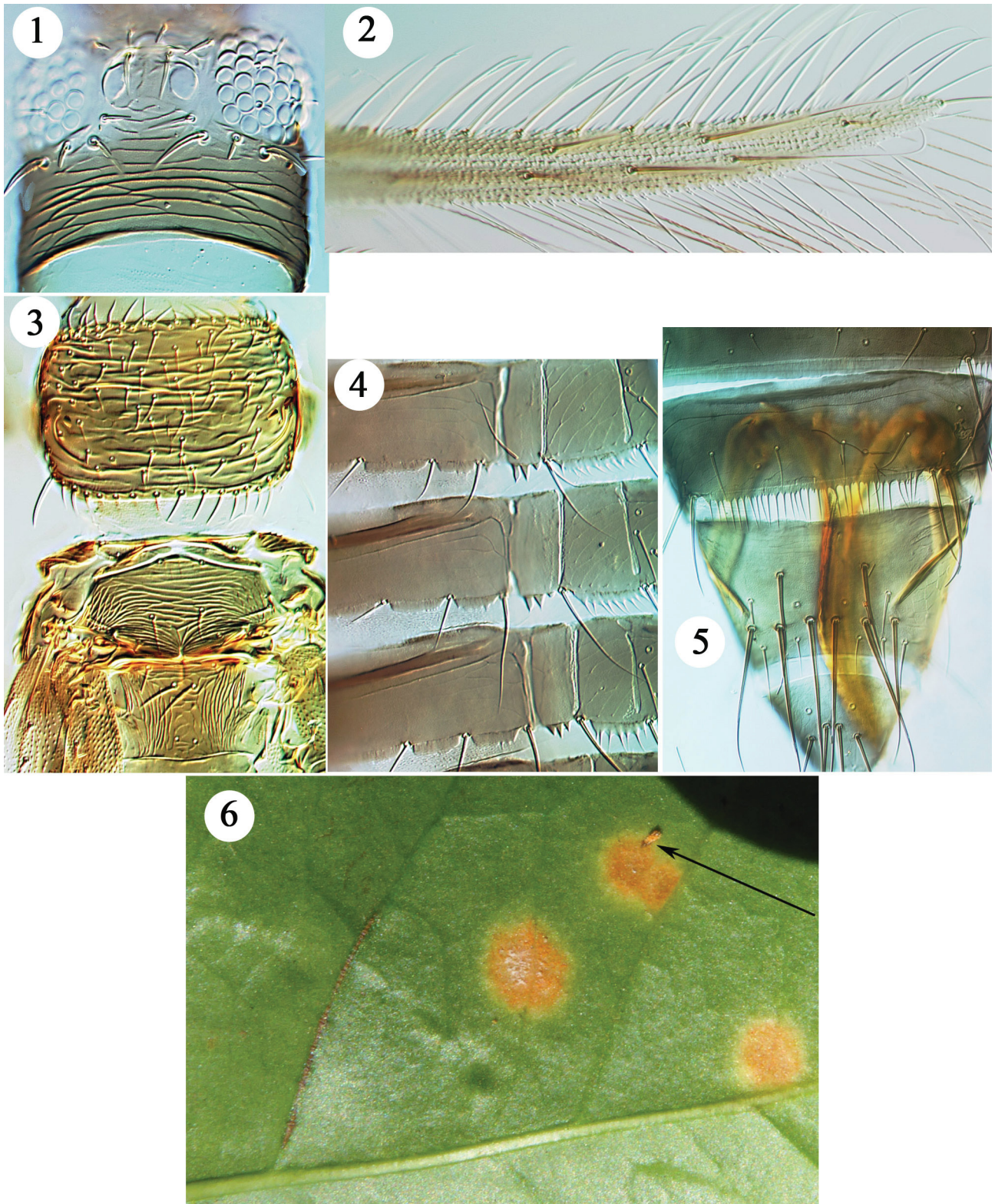
Fungus-feeding is common amongst members of the family Phlaeothripidae that live on dead branches and leaves (Dang *et al.* 2014). In contrast, associations with fungi are rare amongst the common thrips of the family Thripidae that live in flowers and on leaves. In this family, two species from Africa in the genus *Craspedothrips* are reported to be associated with the rust fungus, *Hemileia vastatrix*, on the leaves of coffee plants (Mound *et al.* 2012), although there are no reports of direct feeding by the thrips on the fungus. However, the two known species of the Asian genus *Euphysothrips* have been observed to feed on the spores of rust fungi at widely separated localities. One of these, *fungivora*, was described by Ramakrishna (1928) in the genus *Anaphothrips*, and he reported this thrips as feeding on “rust” on wheat plants at Coimbatore, India. Ananthakrishnan (1969: 5) subsequently referred to this species as “feeding on the spores of wheat rust, *Puccinia graminis*”. The second species of *Euphysothrips* was described by Ramakrishna and Margabandhu (1939) as a new genus and species, *Megaphysothrips subramanii*, from Mysore in southern India. These authors stated that this thrips was found feeding on coffee rust, and a similar feeding association on coffee was reported from Timor in 1967, when specimens of *subramanii* were submitted for identification to the Natural History Museum, London. In Timor Leste during August 2018, adults and larvae of *subramanii* were found commonly on the leaves of coffee plants. The thrips were living only on the reddish-pink patches of *Hemileia vastatrix* fungus (Fig. 6), and not freely exploring the rest of the leaf surface. Both adults and larvae were difficult to see on these patches of fungus, because each individual was noted to carry a covering of coloured spores. This pinkish covering was shed only when an individual was disturbed by attempts to collect them with a small brush. There was no evidence of feeding damage to the coffee leaves by the thrips, and it appears that *subramanii* is probably dependent on the rust fungus for its nourishment.

Apart from a few comments by zur Strassen (2003) no formal diagnosis of the genus *Euphysothrips* has been published. Moreover, the only published means of distinguishing the two included species is in the uninformative key to Thysanoptera genera from India provided by Ananthakrishnan and Sen (1980: 28). The objective here is to rectify these omissions.

***Euphysothrips* Bagnall**

Euphysothrips Bagnall, 1926: 646. Type species: *Euphysothrips minozzii* Bagnall.

Diagnosis: Thripinae with antennae 7- or 8-segmented, segment I without paired dorso-apical setae, III and IV each with a long, forked sense cone and apex constricted, III–VI with microtrichial rows on both surfaces. Head with 3 pairs of ocellar setae, pair III just within ocellar triangle posterior to fore ocellus; postocular setae pair I close behind ocelli, pairs II and IV long and stout, arranged in a transverse row; mouth cone slender, extending across prosternum, maxillary palps long and 3-segmented. Pronotum with prominent sculpture lines; anterior margin with row of 4–7 pairs of setae, posterior margin with 8 pairs of setae of which one posteroangular seta is longer on each side. Mesonotum with strong sculpture lines, anterior paired campaniform sensilla present, median setae far in front of posterior margin. Metanotum strongly sculptured, campaniform sensilla present or absent, median pair of setae far from anterior margin. Mesosternal furca with spinula, metasternal furca without spinula. Fore wing first vein with 3 widely spaced setae on distal half, second vein with 4 widely spaced setae; clavus with 5 veinal and one discal setae. Tergites I and II transversely sculptured, median setal pair small and anterior to campaniform sensilla, III–VII medially with few or no sculpture lines; II–VII posterior margin with broad craspedum; VIII with long microtrichial comb arising from a narrow craspedum; IX with prominent mid-dorsal setae, anterior campaniform sensilla present or absent; X with longitudinal split. Sternites without discal setae; II with 2 pairs of marginal setae, III–VII with 3 pairs; posterior marginal craspedum present or absent; pleurotergites with posteromarginal fringe of long microtrichia. Male with small pore plate on each of sternites III–VII; tergite IX with long slender setae.



FIGURES 1–6. *Euphysothrips subramanii*. (1) head; (2) fore wing apex; (3) pro, meso & metanotum; (4) sternites and pleurites IV–VI; (5) tergites VII–X; (6) female covered in spores on patch of *Hemileia vastatrix*.

Comments. Amongst the Thripinae this genus is distinguished by the transverse row of prominent postocular setae with postocular setal pair I placed close behind the ocelli (Fig. 1), and the large number of small setae on the anterior and posterior margins of the pronotum (Fig. 3). The comb of long microtrichia on tergite VIII is unusual in both species in that these microtrichia arise from a distinct craspedum (Fig. 5). The key to species below indicates some interesting differences between the two species, particularly the presence/absence of campaniform sensilla, sternal craspeda, and a pair of minute setae on the second abdominal sternite. The genus differs from *Craspedothrips* in lacking paired dorso-apical setae on the first antennal segment, and also in the few setae on the first and second fore wing veins.

Key to species

1. Fore wing veins with longest setae no longer than width of wing; antennae 7- or 8-segmented; pronotum anterior margin with 8–10 irregularly spaced setae; metanotum without paired campaniform sensilla; tergite IX with anterior pair of campaniform sensilla present; sternites without craspeda; sternite II with no discal setae; male sternites III–VII each with small, transversely stretched pore plate *minozzii*
- . Fore wing veins each with 2 or more setae exceptionally long and fine, more than twice as long as median width of wing (Fig. 2); antennae 8-segmented; pronotum anterior margin with continuous row of about 16 equally sized setae (Fig. 3); metanotum with paired campaniform sensilla present (Fig. 3); tergite IX without anterior pair of campaniform sensilla (Fig. 5); sternites with craspedum lobed between marginal setae (Fig. 4); anterior half of sternite II with 2–4 minute discal setae; male sternites III–VII each with small oval pore plate *subramanii*

Euphysothrips minozzii Bagnall

Euphysothrips minozzii Bagnall, 1926: 646

Anaphothrips fungivora Ramakrishna, 1928: 268. Synonymised by Bhatti, 1972: 149

Bagnall collected this species from the flowers of *Clematis vitalba* [Ranunculaceae] at Perpignan, southern France. Over subsequent years the species was discovered widely, and zur Strassen (2003) listed it from Austria, Turkey, Canary Islands, Egypt (Sinai), Iran, Yemen, India, Cape Verde Islands, South Africa, and Moçambique. Moreover, Tyagi and Kumar (2016) recorded this thrips from southern India in Maharashtra and Tamil Nadu. Specimens from many of these localities have been studied, including Bagnall's original "Type" from southern France (Mound 1968). Despite all these distribution records, neither Priesner (1965: 292–294), Bhatti (1972), nor zur Strassen (2003: 192) provided any precise host association, merely recording that specimens were primarily taken from Poaceae and Juncaceae. In contrast, as noted above, both Ramakrishna (1928) and Ananthakrishnan (1969: 5) referred to this thrips as feeding on "rust" on wheat plants. However, further observations are needed to confirm this host association. The possibility that *minozzii* may be dependent on rust fungi associated with Poaceae, including wheat rust, deserves closer investigation.

Euphysothrips subramanii (Ramakrishna & Margabandhu) (Figs 1–5)

Megaphysothrips subramanii Ramakrishna and Margabandhu, 1939: 25

Described from Mysore in Karnataka State, this species is also recorded in India from Tamil Nadu and West Bengal by Tyagi and Kumar (2016). Specimens in the Natural History Museum, London, from these Indian States have been studied, and these were taken from coffee with "diseased leaves" or specifically in association with *Hemileia vastatrix*. The field observations quoted above from Timor Leste suggest that this thrips is probably dependent on this rust fungus for its life history.

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